PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Michael Stefan COX, et al.

Docket No: Q63167

Appln. No.: 09/801,707

Group Art Unit: 2143

Confirmation No.: 5115

Examiner: Arrienne M. LEZAK

Filed: March 09, 2001

For: IP/DATA TRAFFIC ALLOCATING METHOD TO MAINTAIN QOS

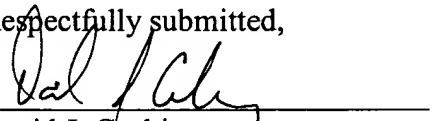
SUBMISSION OF PRIORITY DOCUMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith is a certified copy of the priority document on which a claim to priority was made under 35 U.S.C. § 119. The Examiner is respectfully requested to acknowledge receipt of said priority document.

Respectfully submitted,



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Date: May 2, 2005

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09/801707
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1 of 1

I, JONNE YABSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Complete specification in connection with Application No. 20795/00 for a patent by ALCATEL filed on 10 March 2000.

I further certify that pursuant to the provisions of Section 37 of the Patents Act 1990 Application No. 20795/00 was treated as a provisional application and reallocated No. PR 3471.

WITNESS my hand this
Thirteenth day of March 2001

J R Yabsley

JONNE YABSLEY
TEAM LEADER EXAMINATION
SUPPORT AND SALES

P/00/011 28/5/91
Regulation 3.2

AUSTRALIA

Patents Act 1990

ORIGINAL
COMPLETE SPECIFICATION
STANDARD PATENT

Invention Title:

"IP/DATA TRAFFIC ALLOCATING METHOD TO MAINTAIN QoS"

The following statement is a full description of
this invention, including the best method of
performing it known to us:

Technical Field

This invention relates to a method and arrangement for improving the quality of service (QoS) of transmissions in a Data Network. An application of such an invention is in the transmission of information over a network using the Internet Protocol (IP).

IP/Data networking is a developing market, and carriers need to be able to provide QoS guarantees for different grades of traffic. At present IP traffic is subject to variable QoS depending on network usage.

Background Art

Extreme Networks US Patent No. 5974467 describes a technique for filtering traffic across a network by the interchange of "menu" and "order" data types in which a sending node transmits a "menu" of the different data types which it has waiting for transmission, and the reply by the receiving node in the form of an "order" selected from the "menu" of the type(s) of traffic the receiving node is able to accept.

This technique requires an exchange of "menu" and "order" messages to filter the data.

Disclosure of the Invention

This specification therefore discloses a method of allocating traffic to a path or paths between a sending node and a receiving node in a network, wherein each message includes a QoS flag,

the method including:

- at the sending node, compiling a traffic status map of the available capacity on the or each practical path between the sending node and the receiving node;
- allocating messages to paths on the basis of its QoS flag, and the available capacity of the paths.

Brief Description of the Drawings

Figure 1 shows an example of version 4 of the IP header.

Figure 2 illustrates the "Type of Service" field of figure1.

Figure 3 illustrates exemplary probability charts for the transmission of different grades of traffic.

Figure 4 illustrates the functional processes in determining the path of a datagram.

Best Mode of Carrying Out the Invention

Our Australian Patent Application No. 44470/99 discloses a technique in which all viable potential paths between source and destination can be used to improve network utilization and decrease overall latency. However, this technique may not be suitable for all classes of traffic, particularly those which require the higher levels of QoS, because in the "all-practical-paths" technique, individual packets will experience varying delays depending on the number of nodes they transit and the current delays in those nodes.

The "all-practical-paths" technique utilizes a network status mapping method under which the nodes are aware of the traffic conditions across the network. Application Number 44470/99 describes an iterative hierarchal structure of interconnected nodes in which the available capacity of each node is reported to the nodes higher in the hierarchy, and which determines an overall availability for the group of nodes reporting to it. This iterative structure means that the overall amount of information exchanged for remote nodes is condensed, while more detailed information is exchanged about proximate nodes. In this manner, a node can determine the available capacity between itself and a destination node over various paths.

However, the "all-practical-paths" technique does not, of itself, guarantee QoS. For example, segments of a message requiring low latency may be sent over paths of differing lengths and experience differing delays.

It is therefore desirable to implement a mechanism which improves the QoS. The Internet Protocol makes provision for a type of service field to indicate the required grade of service of a datagram.

The Internet Protocol (IP) header format is shown in Figure 1 and includes the following fields:

1. Version;

2. IHL (Internet Header Length)
3. Type of Service
4. Total Length
5. Identification;
6. Flags;
7. Fragment Offset;
8. Time to Live;
9. Protocol;
10. Header checksum;
11. Source IP Address;
12. Destination IP address;
13. Options;
14. Padding

The type of Service (Field 3) is 8 bits with the following functions:-

- 0-2 Precedence;
- 3 0 = Normal delay, 1 = Low Delay
- 4 0 = Normal Throughput, 1 = High Throughput
- 5 0 = Normal Reliability, 1 = High Reliability
- 6-7 Reserved.

The Precedence Hierarchy is :-

-	111	Network Control	011	Flash
-	110	Internetwork Control	010	Intermediate
-	101	CRITIC/ECP	001	Priority
-	100	Flash Override	000	Routine

Thus the type of service field specifies the required grade of service required.

An example of the operation of the invention will be described in the context of an IP/Data Network.

In figure 4, at a source node, a datagram 41 includes a header 42. The header includes a Type of Service (ToS) field 43 from which a required QoS can be determined by analysing the ToS information. Each node has access to network architecture information 45 which is combined in path identification process 47 with

network traffic status information 46 and the destination address in process 50, to determine the available paths from the source to the destination, and the available capacity for each of those paths.

The required QoS information 44 is then combined with the path/capacity information in a path selection process 48 to determine over which path or paths the datagram is to be transmitted.

The ToS field may be used directly to correspond to a QoS, or it may be translated, eg, via a look-up table to a hierarchical priority list implemented in the network which the traffic transits.

In a preferred embodiment, the path selection process implements the following:

From the ToS field, a required QoS is selected at 44 from two or more available options. In this example the options are, in order of priority.

EF = Expedited Forwarding
characteristics:
Low Latency, Low Jitter, No discard
Applications

In the path selection process 48, the QoS is implemented as follows:

EF QoS datagrams are allocated to the shortest path plus the next shortest path which have available capacity;

AF1 QoS datagrams are allocated to the same paths as the EF datagrams plus the next shortest paths, with EF taking precedence.

BE QoS datagrams have the same paths as AF1 plus the next shortest paths, with BE taking precedence

ETC....

Thus the highest priority datagrams have precedence over the shortest available paths, each lower priority in the hierarchy being progressively allocated to the longer path.

In periods of low use, low priority datagrams may use shorter paths, but, as use increases and higher priority traffic needs to be sent, low priority datagrams are pushed to longer path.

This technique facilitates efficient use of the network by distributing traffic over the available paths, while ensuring the higher priority datagrams have low latency by transmitting them on the shortest paths.

Figure 3 illustrates the probability with which different classes of traffic would be allocated to a 500mb/s link. The curves illustrate the traffic loss, and the probability of allocating traffic to the link is the proportion between the probability = 1 line and the traffic loss curve.

For example there is a 10% probability of allocating additional EF traffic to the link when the link load is 50mb/s,

- a 20% probability of allocating AF1 traffic,
- a 40% probability of allocating AF2 traffic, and
- an 80% probability of allocating BE traffic.

The claims defining the invention are as follows:

1. A method of allocating traffic to a path or paths between a sending node and a receiving node in a network, wherein each message includes a QoS flag,

the method including:

- at the sending node, compiling a traffic status map of the available capacity on the or each practical path between the sending node and the receiving node;
- allocating messages to paths on the basis of its QoS flag, and the available capacity of the paths.

2. A method as claimed in claim 1 in which the QoS hierarchy allocates the highest priority messages to the shorter paths with available capacity in preference to lower priority messages, the lower priority messages being allocated to longer paths as traffic conditions require.

3. A method of allocating traffic in a network substantially as herein described with reference to the accompanying drawings.

DATED THIS THIRD DAY OF MARCH 2000

ALCATEL

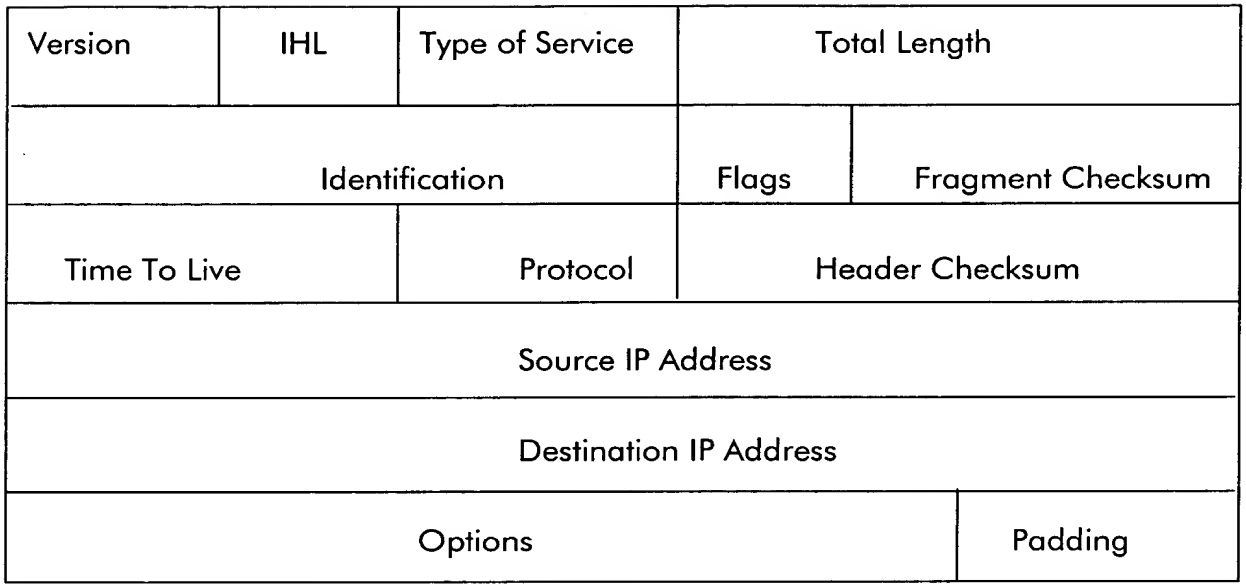
Version
IHL
Type of Service
Total Length
Identification
Flags
Fragment Checksum
Time To Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
Options
Padding

Figure 1

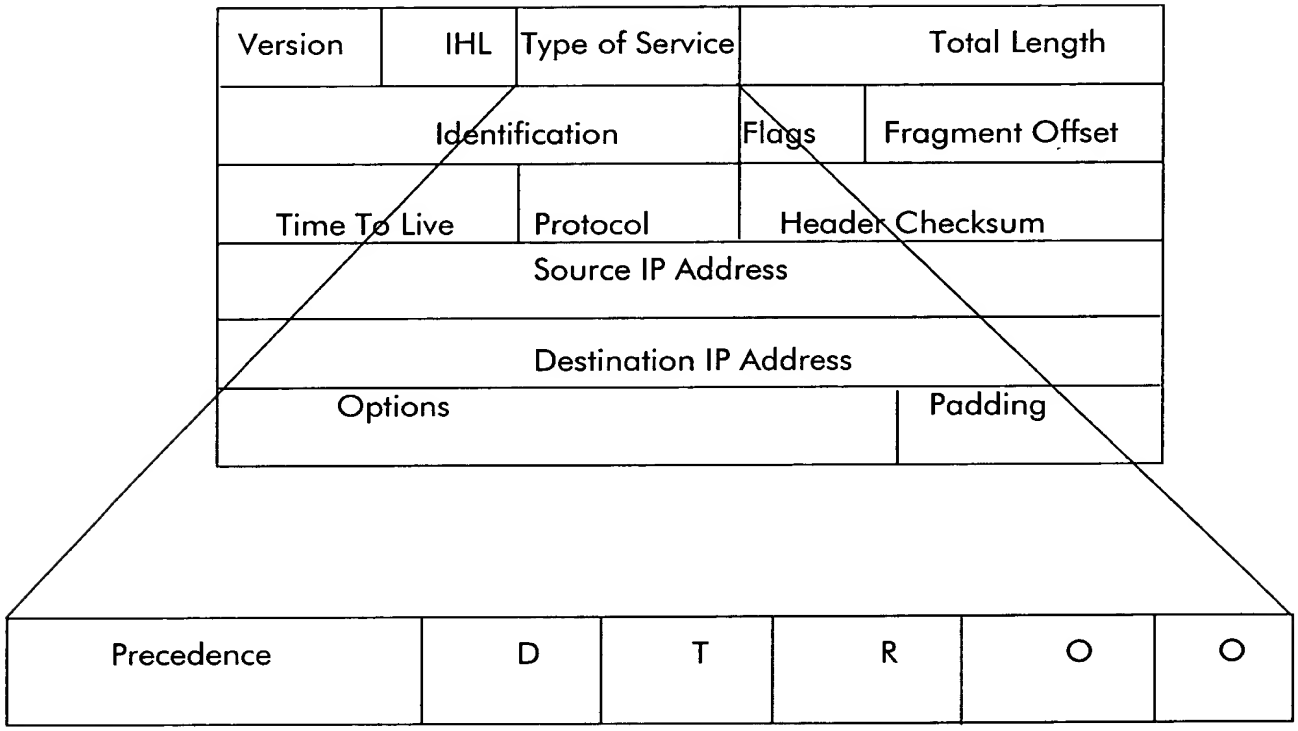
Version
IHL
Type of Service
Total Length
Identification
Flags
Fragment Offset
Time To Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
Options
Padding
Precedence
D
T
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FIGURE 2

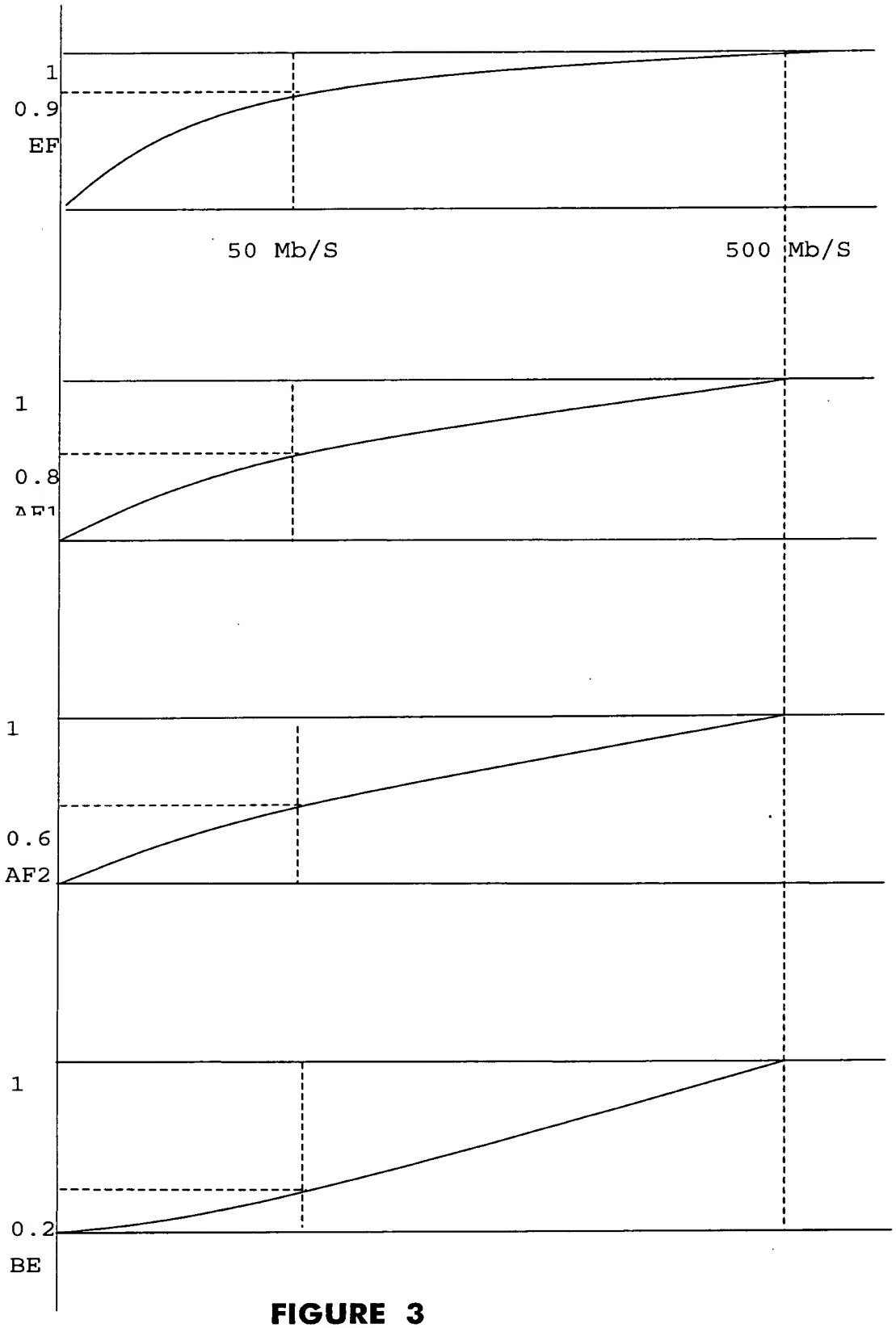

FIGURE 3

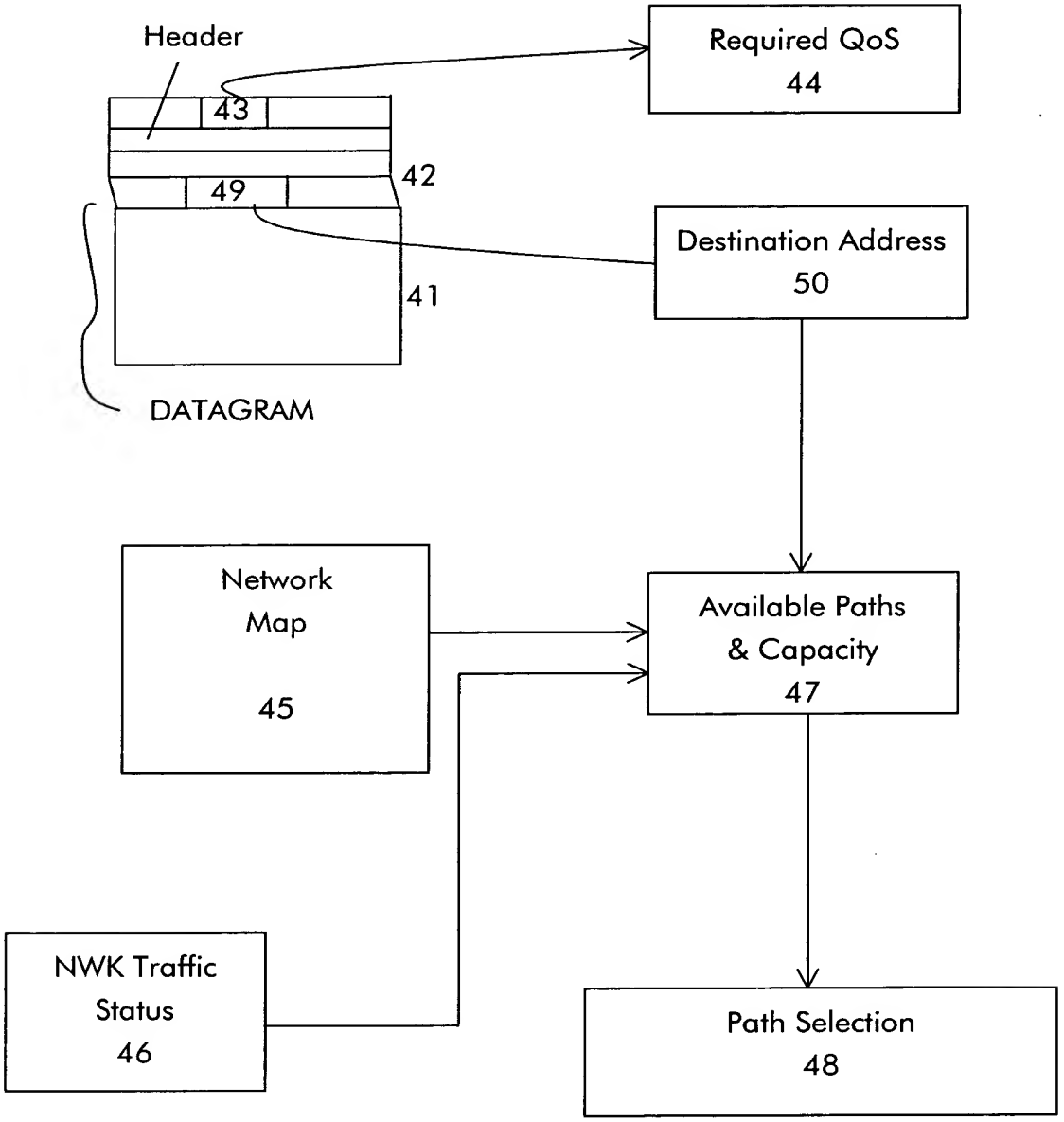
Header
43
42
49
41
DATAGRAM
Required QoS
44
Destination Address
50
Network
Map
45
Available Paths
& Capacity
47
NWK Traffic
Status
46
Path Selection
48

FIGURE 4

ABSTRACT

This invention provides a means of improving quality of service, and is of particular use in a network using multi-path. The sending node determines the available paths to the receiving node from a network map 45, and the available capacity of the paths from a traffic status report 46, and selects the path for a datagram 41 on the basis of the QoS 44. Datagrams 41 with the requirement for a Type of Service 43 having high priority (eg. Low latency) are allocated to the shortest path(s) with the available capacity and lower priority datagrams are progressively allocated to longer paths.